

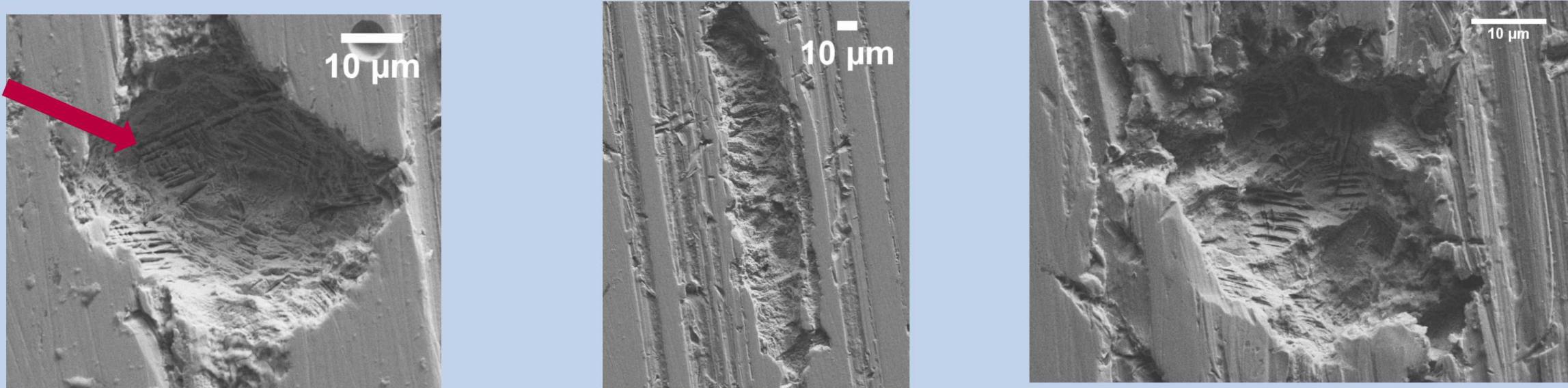
EXPERIMENTAL SETUP AND DISCUSSION

Full Immersion Exposures

- All exposures carried out at 35 °C on 1"x 2" coupons with a 120 grit finish

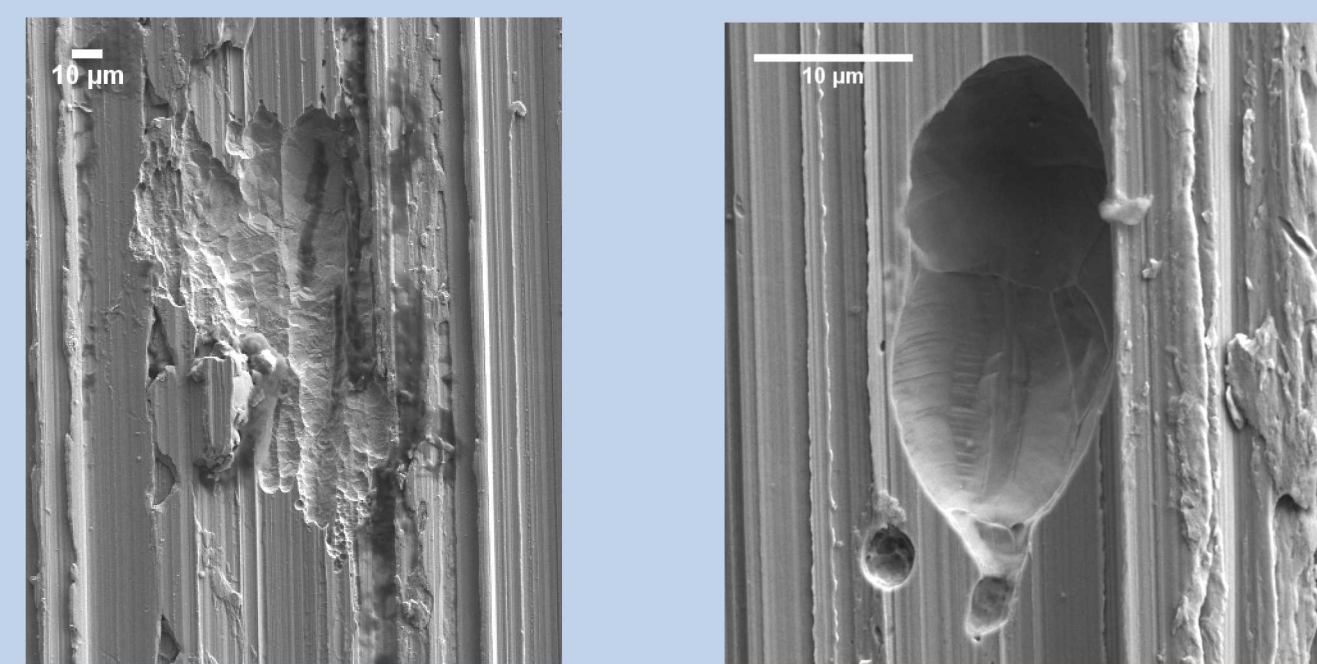
Salt Type	Concentration	Equivalent RH	Steel Type	Test Duration	Pitting Present	Microcracks Present
MgCl ₂	0.566 M	MgCl ₂ Concentration at 76% RH	304L	1 week	No	No
			304L	2 weeks	No	No
			304H	7 weeks	Yes	No
	2.61 M	Equivalent Chloride Concentration of NaCl at 76% RH Seawater	304L	1 week	No	No
			304L	2 weeks	Yes	No
	5.22 M	NaCl concentration at 76% RH Seawater	304H	7 weeks	Yes	No
			304L	1 week	Yes	No
			304L	2 weeks	Yes	No
Artificial Seawater	N/A	40% RH	304L	2 weeks	Yes	Yes
Artificial Seawater	N/A	76% RH	304L	2 weeks	Yes	No

0.566 M MgCl₂, 7 Weeks



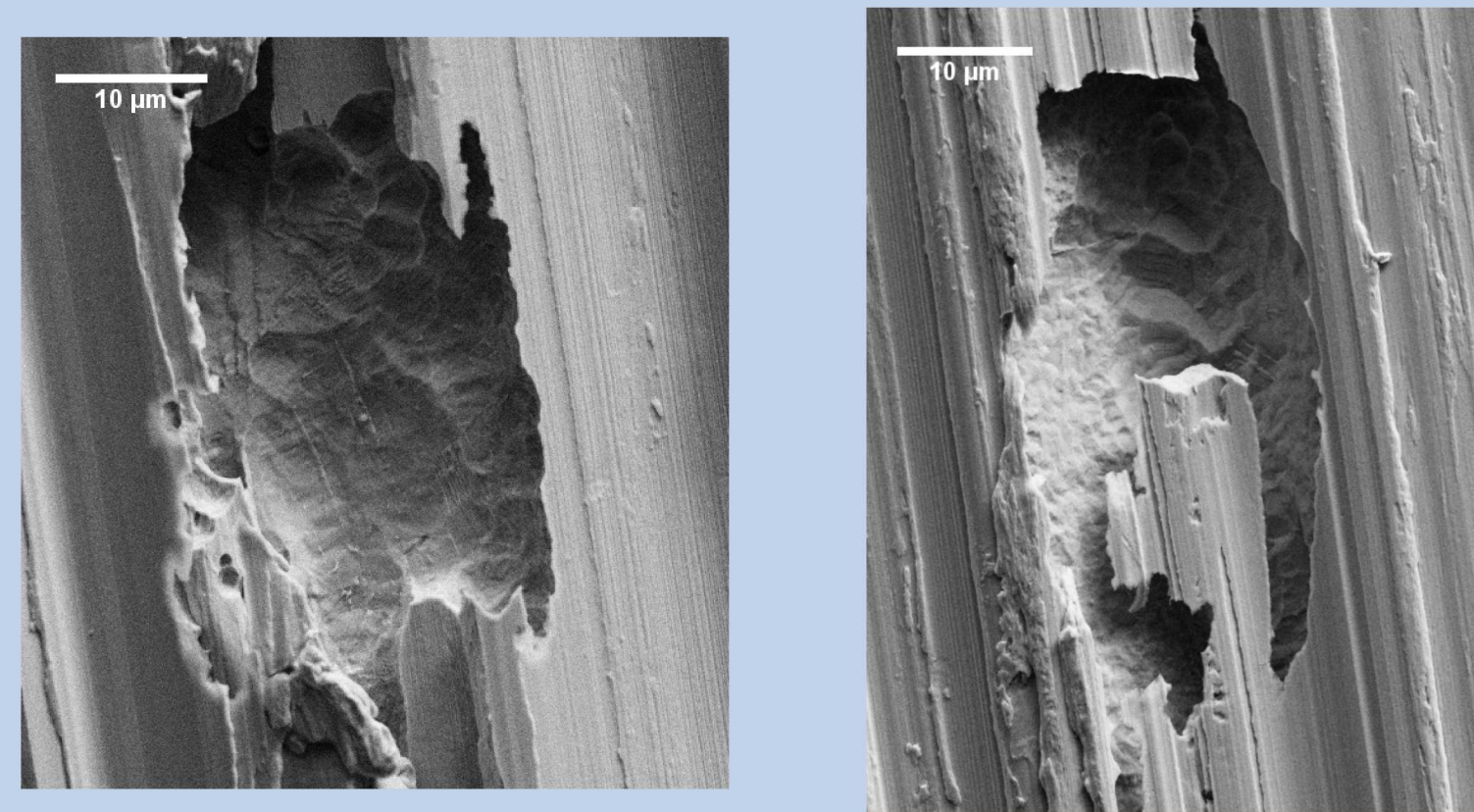
- Pits are more irregular in shape with cross-hatching on bottom of pits

2.61 M MgCl₂, 2 Weeks



- Pitting infrequent on surface
- No clear shape or morphology patterns
- Any pitting found resembles NaCl under similar conditions

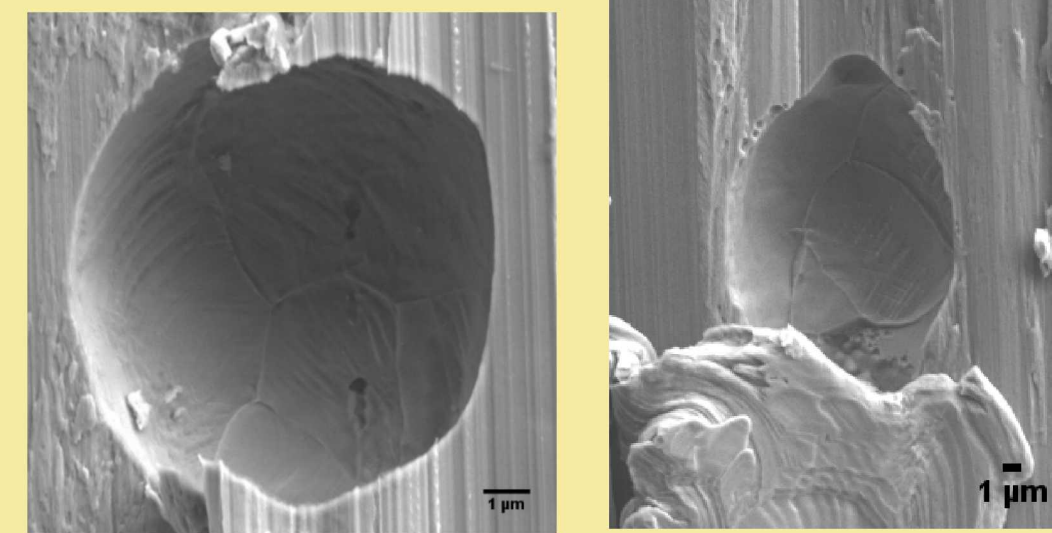
2.61 M MgCl₂, 7 Weeks



- Pits appear slightly elongated along grinding direction
- Some striation due to slip planes along pit bottom
- Cavitation morphology also present
- Growth into small elongated sections that may potentially serve as crack initiation points

Under full immersion conditions, cathodic area is maximized.

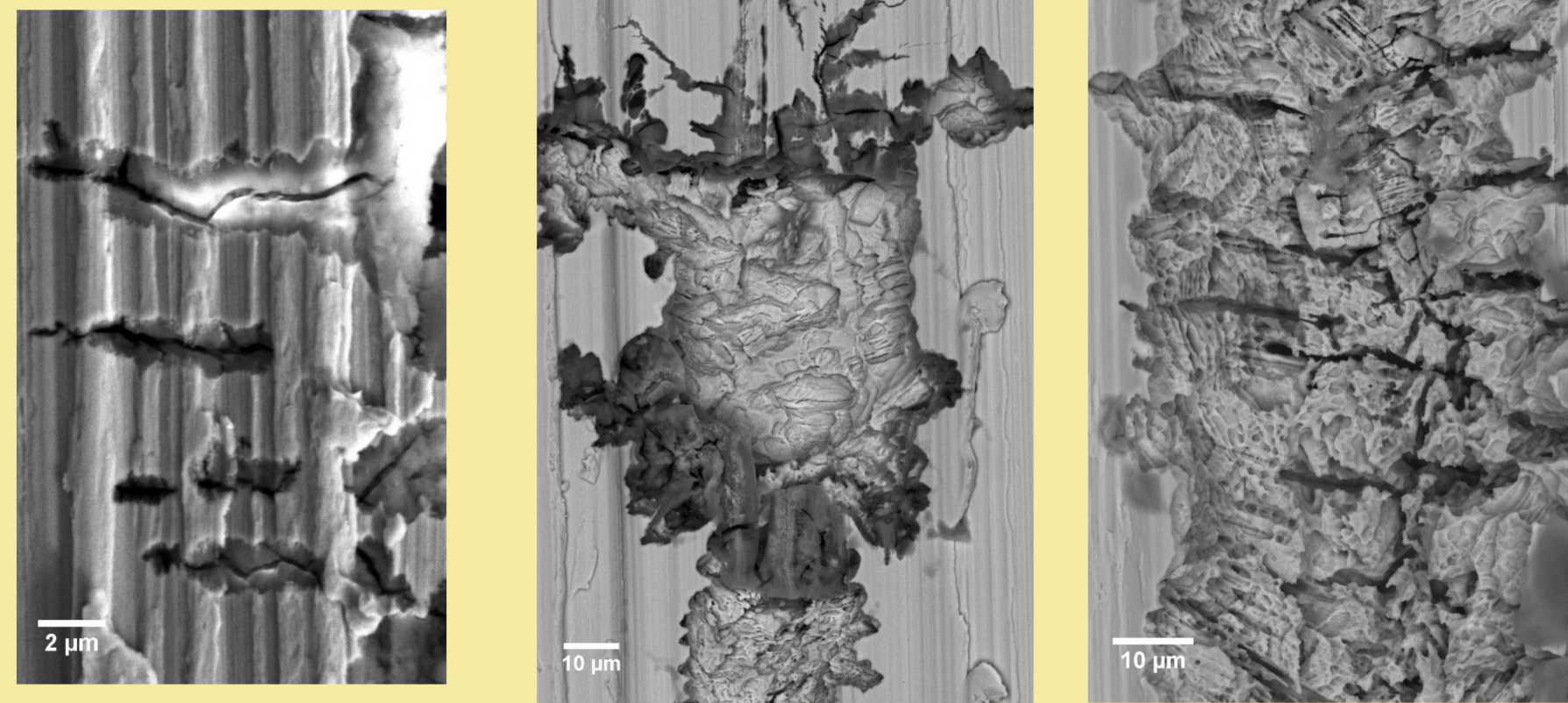
76% RH Seawater, 2 Weeks



- Very small, circular pits with smooth morphology
- Slight striation along slip bands
- Infrequent pitting

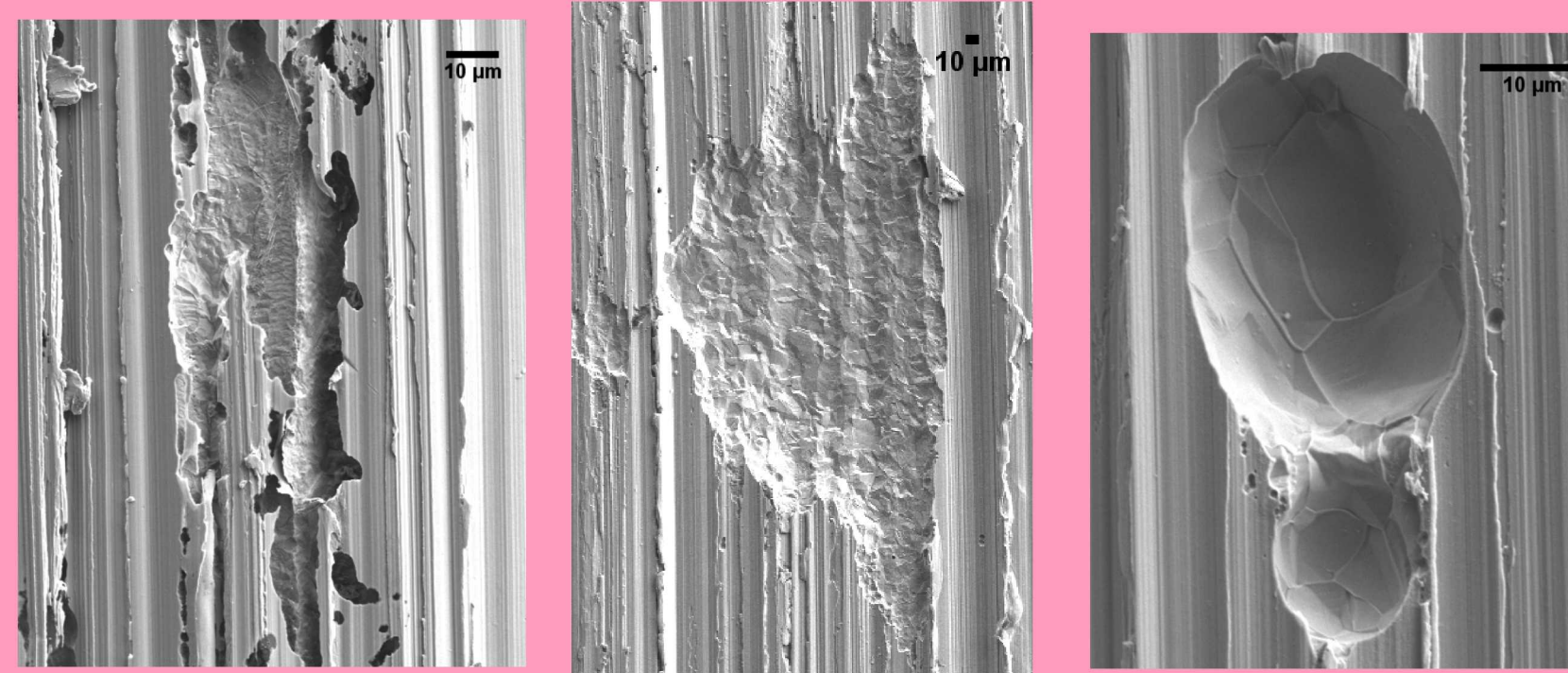
40% RH Seawater, 2 Weeks

- Pits exhibit cross-hatching morphology with deep lines along bottom of pit
- Pitting preferentially along grind lines
- Microcracking initiates from edges of pits
- Cracks reach 10s of microns in length



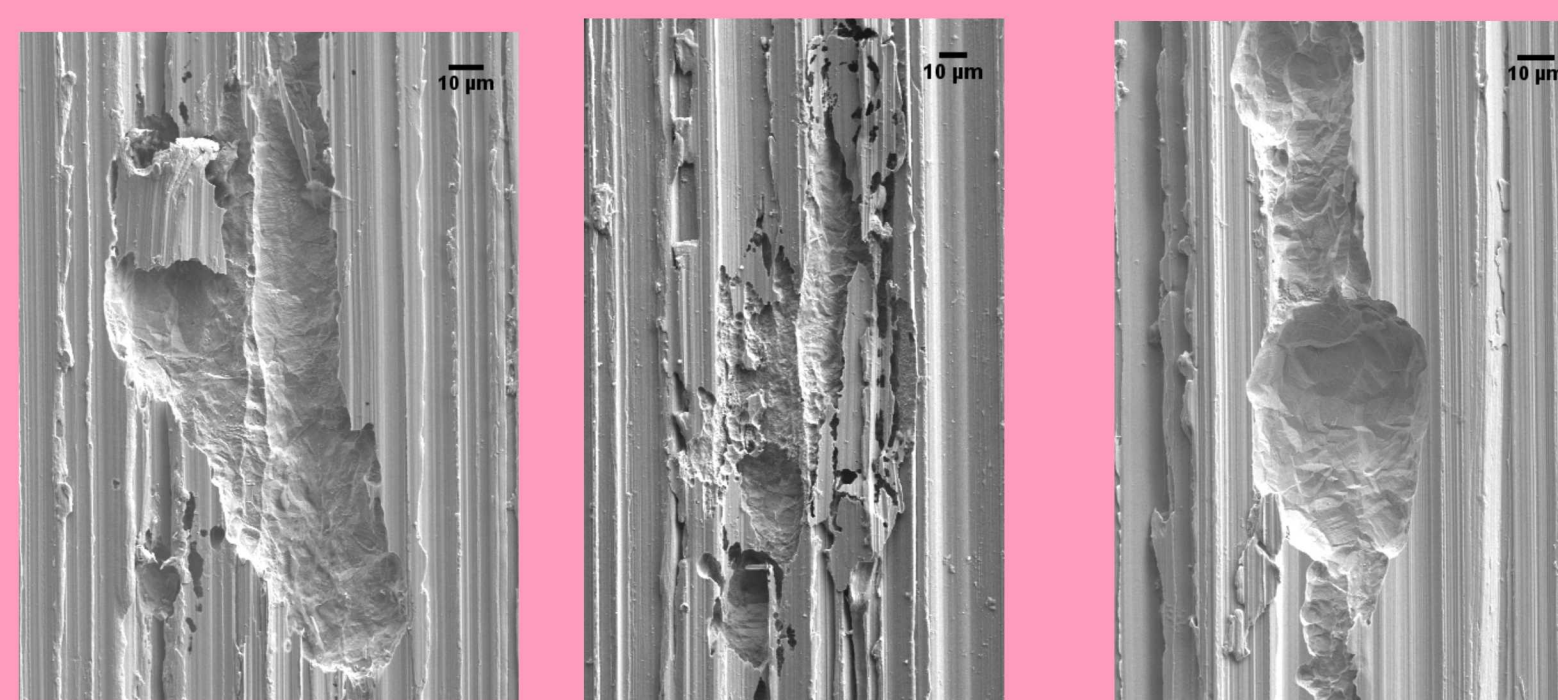
- Pitting in 2.61 M MgCl₂ resembles shape and morphology more of 5.22 M NaCl (equivalent chloride concentration) and 76% RH seawater (dominant species is 5.22 M NaCl) than that of 0.566 MgCl₂ (similar chemistries)
- 0.566 M MgCl₂ has the lowest chloride concentrations but exhibited cross-hatching morphology if pitting did occur
- Microcracking only seen under 40% RH conditions which could be caused by the presence or specific concentration of a currently unidentified species in the brine

5.22 M NaCl, 1 Week



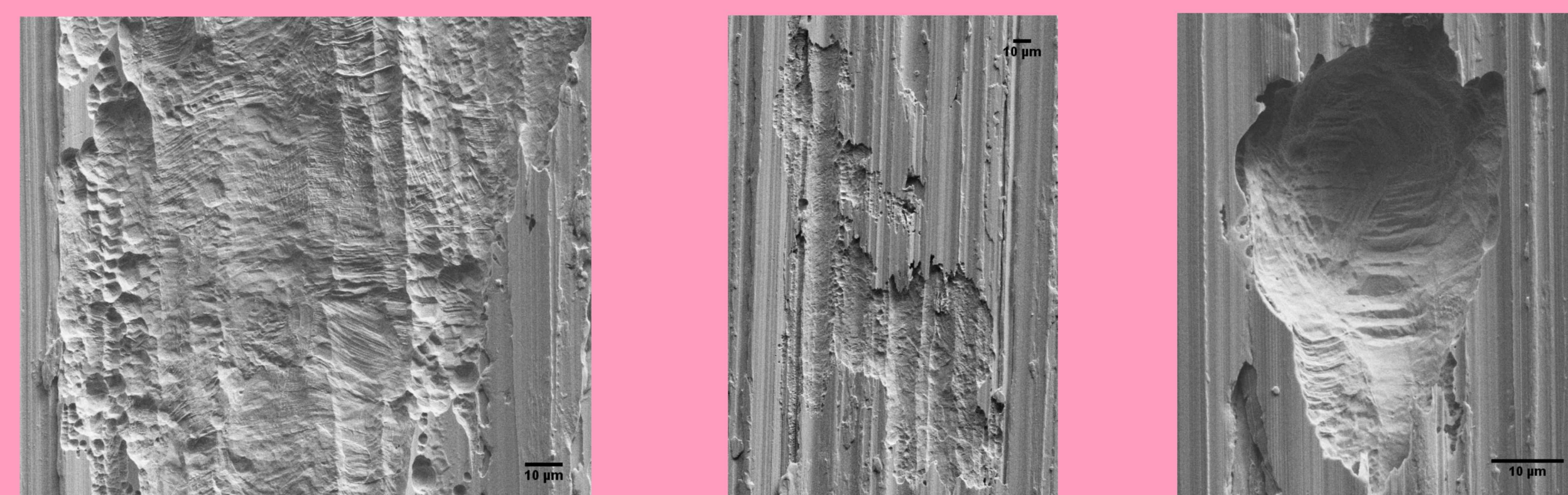
- Smaller pits are round and smooth with major axes parallel to grind direction
- Larger pits are shallow, bumpy, and corrode preferentially along grind lines

5.22 M NaCl, 2 Weeks



- Pitting preferentially along grind lines
- Appears to initiate from more circular pits initially then corrodes along grind direction

5.22 M NaCl, 7 Weeks



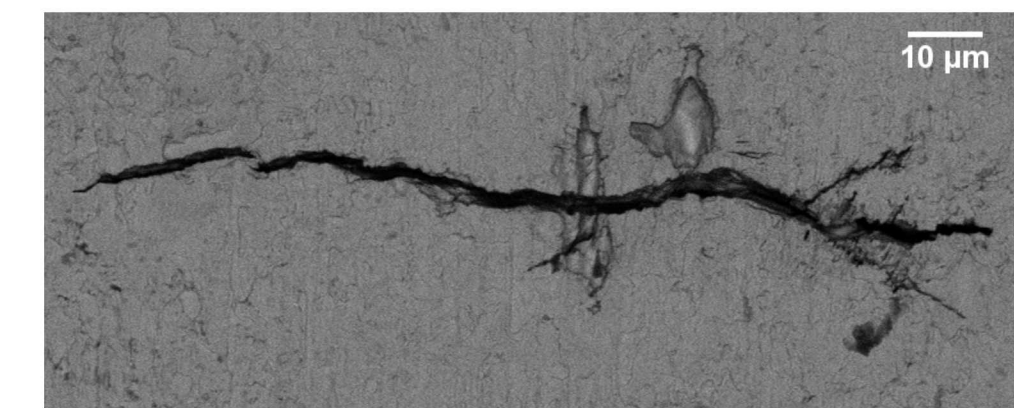
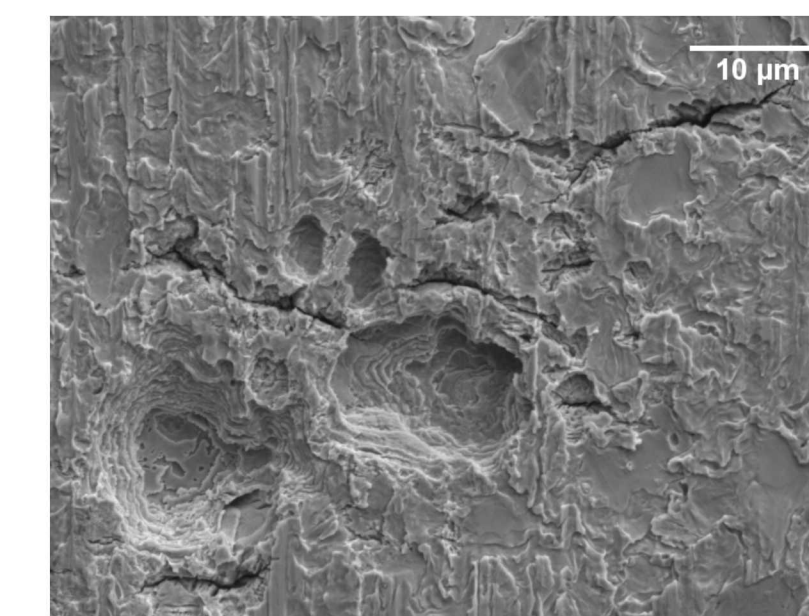
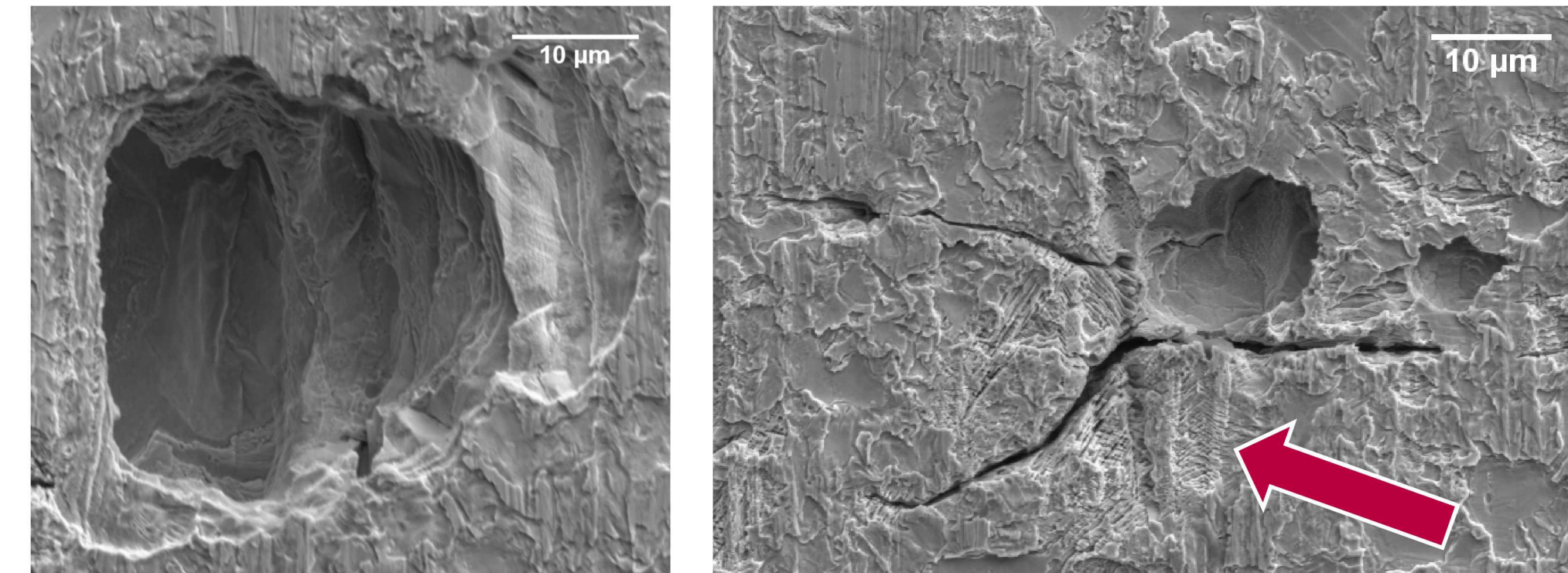
- Similar corrosion patterns to earlier exposure
- Smaller, more circular pits showing striation along slip planes at pit bottom

Tensile Bar Examination

Broad Side

Conditions:

- Printed at 300 µg/cm² ASTM sea salt
- 6 months exposed at 35 °C and 40% RH
- Afterwards, 6 months pulled at a load of σ_y

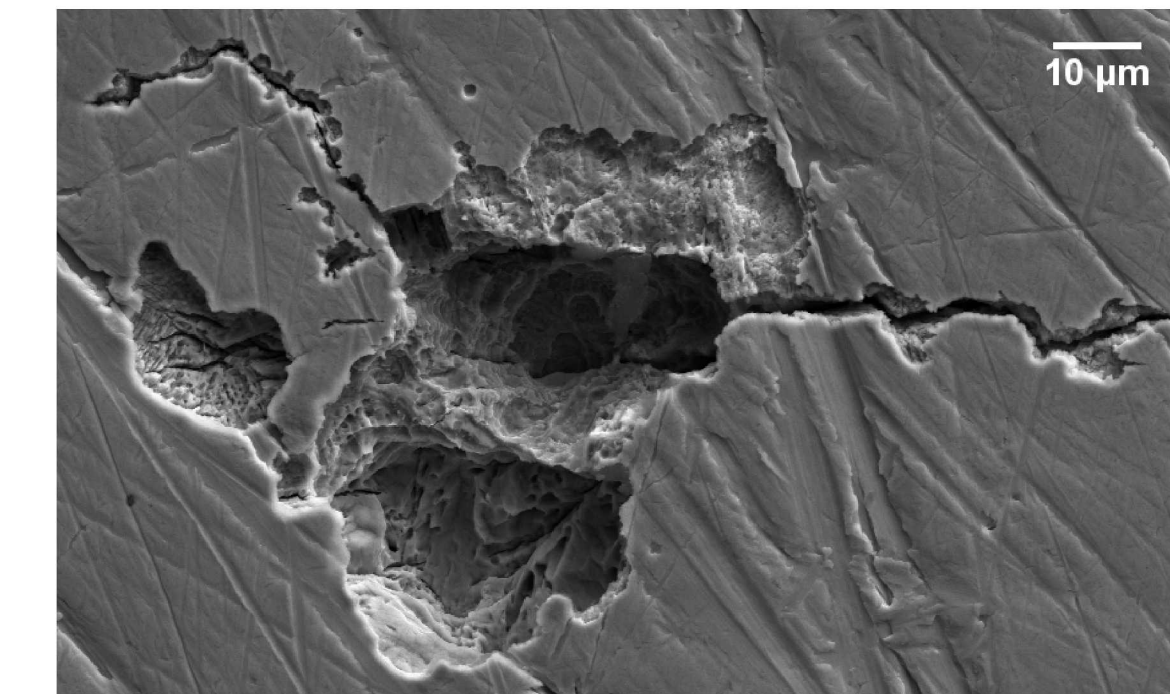
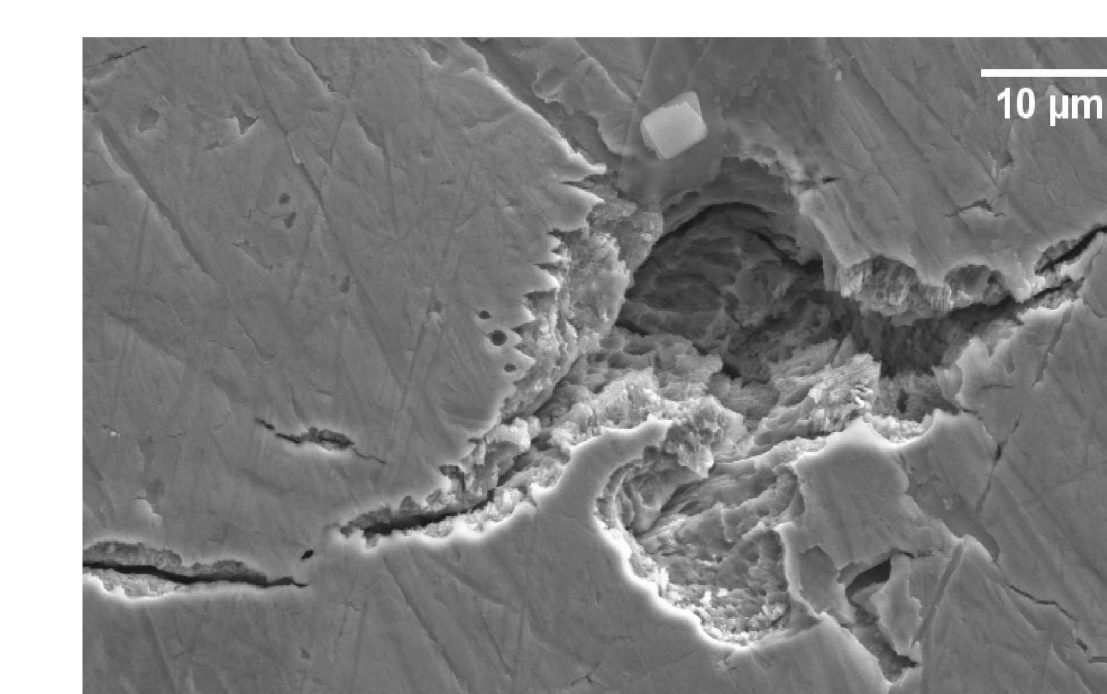
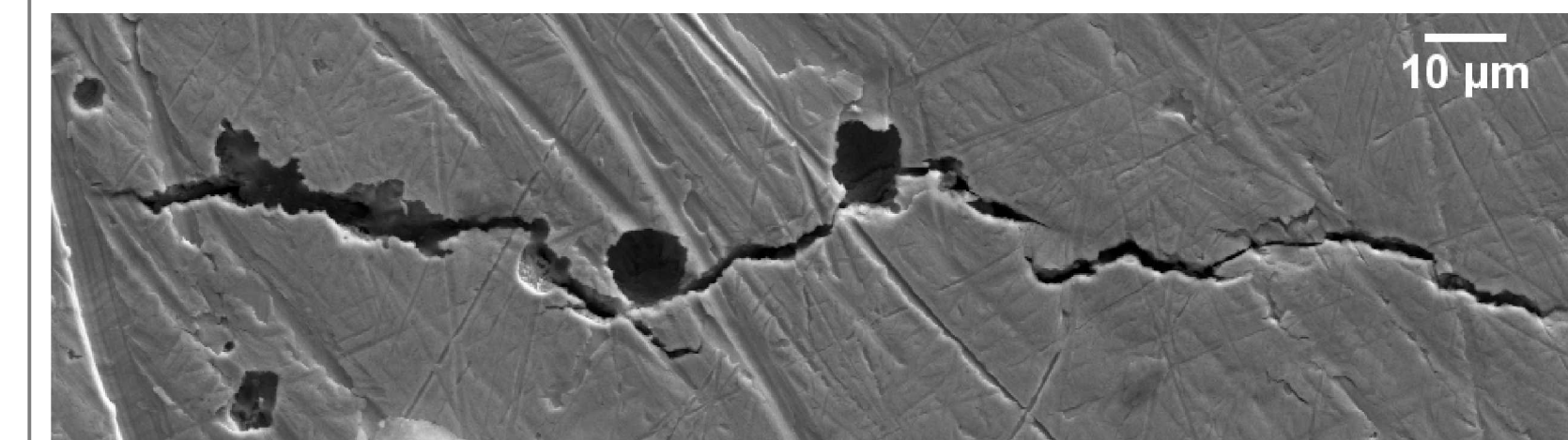
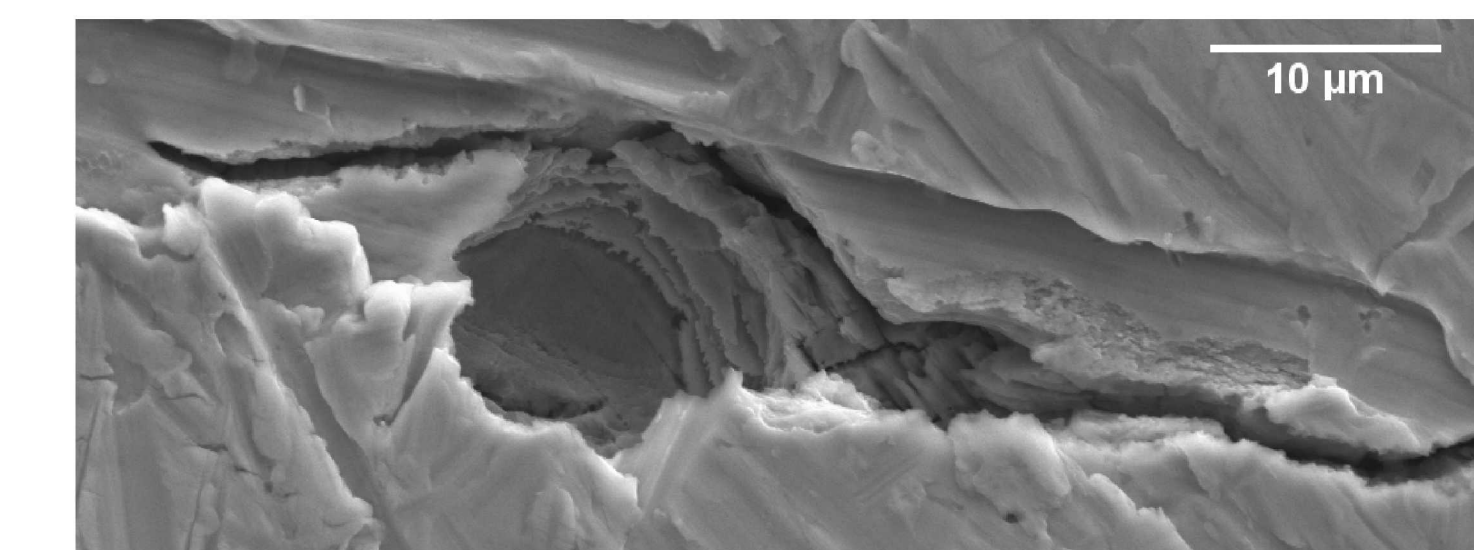
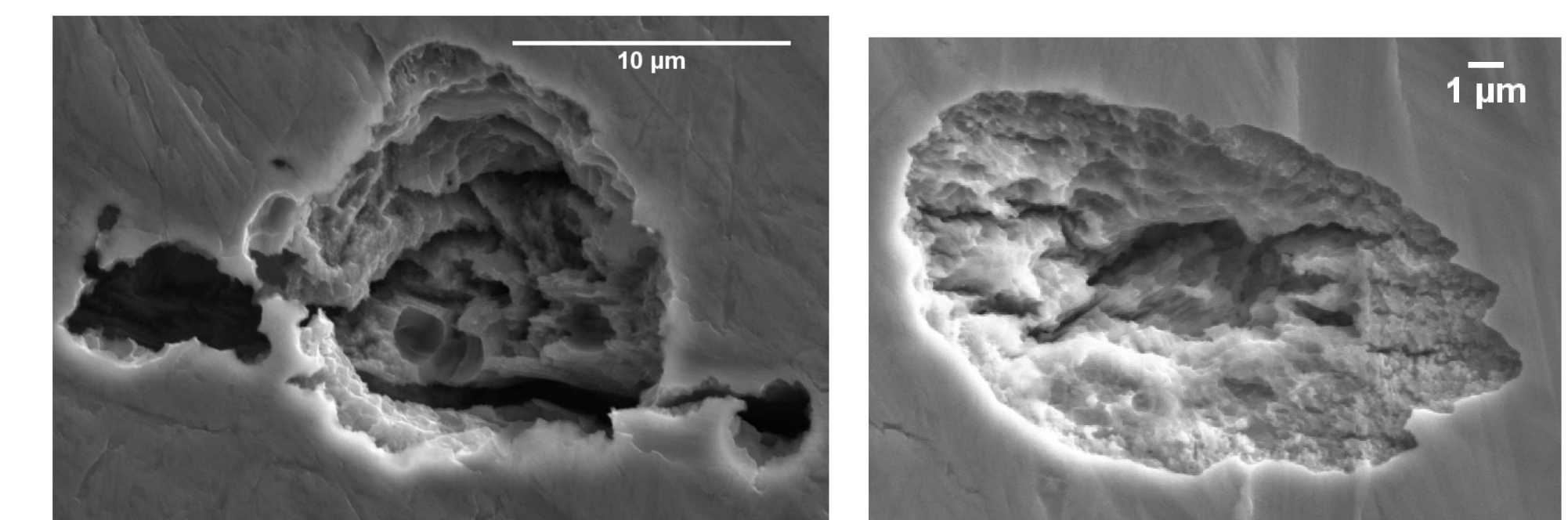


- No crosshatching in the bottom of the pits but crosshatching is present on the surface
- Pits are more irregular in shape with a smooth morphology resembling rock erosion
- Pit morphology does not match any from the droplet and immersion exposures
- Cracking present near pits but not necessarily originating from them
- Some crack branching occurring
- Surface roughness appears to be different from coupons used in droplet and immersion exposures

Narrow Side

Conditions:

- Printed at 300 µg/cm² ASTM sea salt
- 12 months exposed at 35 °C and 40% RH
- Afterwards, 6 months pulled at a load of σ_y



- Pits have a jagged morphology with many potential crack initiation points
- All cracks observed initiated from pits and in some instances connect multiple pits
- Pit morphology resembles morphology in 40% RH artificial seawater immersion tests
- Wide variation in pit size